THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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THE TIDE AS A MOTIVE POWER.

NEXT to the electric light, the subject which is likely to create a stir in the electrical and engineering world is undoubtedly the transmission of power to a distance. As yet the importance of the question seems hardly to be grasped, though there are signs of a movement to bring the idea prominently forward. The remarkable paper read by Professor Ayrton before the British Association has given another kick to the ball which has hitherto rolled but sluggishly.

The importance of the solution of the general problem of the transmission of power to a distance cannot be exaggerated. Once fairly set on foot, we may look with equanimity upon the exhaustion of our coal-fields. The solution of the problem means heat, light, and every other form of energy obtained in inexhaustible quantities and at any locality. The use of the tide as a motive power has been often suggested, but practically nothing has been done in this direction, and the reason, we think, is not far to seek. The mountain cannot come to Mahomet, but neither can Mahomet go to the mountain. In other words, we cannot bring our manufactories to the coast to utilise the motive power of the sea, and as yet no practical means has been devised for conveying this power inland. But, although the conveyance of power is of primary importance in carrying out the idea of utilising the energy of the tide, yet a great deal may be done, we think, in the direction of employing the tide to illuminate many of our seaport towns and watering-places, also to illuminate our lighthouses, the means being, of course, a dynamo-electric machine turned by an engine worked by the daily rise and fall of the tide. Many difficulties lie in the way of the accomplishment of the task which are so self-evident as to hardly require enumerating. The method—which we believe is still in use—of filling reservoirs at the rise of the tide, and allowing these to empty themselves at the fall, and by this means to turn a water-wheel, requires considerable space, and waste land does not abound in England. It is true this necessary space could be obtained by forming artificial reservoirs off the shore, but such constructions must necessarily be expensive. Practically, the question will undoubtedly in future resolve itself into one of expense; the means of effecting the objects in view are rapidly approaching practicability. How are these means to be so shaped that the financial aspects of the question may be favourable? The answer to this question has yet to be worked out, and we hope again to refer to it.

NOTE-BOOK PROOFS OF INVENTION.

IN the American *Journal of the Telegraph* for September 1st, there is a letter from Mr. W. F. Jones, of Chicago, claiming priority of invention for Muirhead and Winter's Quadruplex System. A sketch of the system of Mr. Jones, dated June 7th, 1877, is also given and witnessed to by another gentlemen, a Mr. C. H. Wilson, whose handwriting is reproduced in fac-simile for the purpose, we suppose, of the better convincing an incredulous world of its authenticity. Now, so far from anticipating the Winter double-tongued relay by his 1877 device, if Mr. Jones and those interested will turn to the *Telegraphic Journal* for October 15th and November 15th, of the year 1875, they will find there a description of this relay by Mr. Winter himself, in a series of articles on duplex and quadruple telegraphy.

Having thus disposed of the somewhat rash claim of Mr. Jones we would willingly say no more, if it had not been that such trumpery proofs of certain American electricians have been far too common of late. Even in the same journal there is one more appropriating the credit of the new French Heraud battery to another American. The time has come to expose the hollowness of these pretensions, which are mostly put forward, we believe, by ill-versed operators, and not by truly scientific American electricians. If the thing goes on, the proverb, "That there is nothing new under the sun," will require a powerful exception in the case of the United States, for it would seem that everything new comes from there. It will soon become impossible for a European electrician to invent anything which has not been known to the Yankees for a generation at least. Should any Englishman hit upon a method of squaring the circle or cutting green cheese from the moon, and fondly believe that he has immortalised his name, he will soon be grievously disillusioned, for the next American mail will present him with one or more letters and fac-simile documents, duly attested and sworn to, each alleging that the circle had been squared by So-and-so, or lunar cheese first potted by Thingamy, in that go-ahead country exactly Such-a-date before.

When it is considered that if this mischievous method of trying to gain the credit of an invention is tolerated, no man's original work will be safe, since it is in the power of any upstart to dispute it by fictitious proofs of this kind, it will be admitted as a working principle that only *publication* to the world should determine the authorship of an invention. We are far from meaning to imply that the American scratch claims in question are not genuine; thus far we believe they are, but the system is a pernicious one, and there is no saying to what evils it might lead if it be not nipped in the bud.

BLAKE'S MICROPHONE TRANSMITTER.

THE form of microphone designed by Mr. Francis Blake of Preston, Massachusetts, and recently introduced into this country by the Telephone Company as a transmitter for working their Bell telephone lines, is, perhaps, the most successful practical microphone which has yet been put together.

In all, or nearly all the microphones hitherto constructed one of the contact pieces is kept in a fixed position, while the other, being free to move to some extent, is constantly held in contact with this fixed piece, and is pressed against it with greater or less force by the vibrations of the diaphragm with which it is connected. In using an instrument of this form it has been found necessary to adjust the initial static pressure between its contact pieces or electrodes with great delicacy and care, in order to secure such a variation of resistance between them under the vibrations of the diaphragm as will enable the current to reproduce in a receiving instrument the sounds which fall upon the transmitting instrument. When such an adjustment has been secured it is easily disturbed by slight causes, such as a change in the temperature of the instrument or a trifling movement of some of its parts in relation to other parts.

By Mr. Blake's arrangement the proper adjustment is, however, easily secured, and is not liable to be disturbed in the practical use of the instrument. Both electrodes are supported in such a manner that they can move freely with the diaphragm. One of them may be attached directly to and be supported by the diaphragm, although it is preferred to support it in contact with the diaphragm from an independent support. The other electrode is so supported as to move freely, but is made so heavy, or is so weighted, that by its inertia it will offer a resistance to the slight and quick vibrations of the diaphragm, which will give a varying pressure between the electrodes and a consequent change in the resistance of the circuit. This second electrode is so supported that the initial static pressure between the two will not be sensibly affected by a change of temperature within the ordinary range of temperatures to which such instruments are exposed. It is placed on the end of a spring whose other end is connected to a lever, by means of which the proper initial pressure between the electrodes and against the diaphragm is obtained.

To secure contact between the electrodes, independently of the pressure against the diaphragm, the electrode next to the diaphragm is supported upon a spring which exerts its pressure against the opposite electrode.

The following drawings fully illustrate the apparatus: Fig. 1 is a plan of the mechanism attached to the top or cover of the box containing the microphone. Fig. 2 is a section of the box and mechanism on the line *x*, *x*, Fig. 1, and shows one of the terminals for making connections with the exterior circuits. Fig. 3 is a transverse section of the said box and mechanism on the line x^1, x^1, of figs. 1 and 2, and showing the terminals for making connections with the exterior circuits. On each of these figures A represents the box or casing in which the microphone is enclosed; the latter being for convenience attached to the cover or top A^1. B represents a metal ring or frame for holding the mechanism of the microphone. It is screwed to the cover A^1, as shown, and has two ears B^1, B^2. On the inner surface of the ring B is a narrow ledge or lip *b*, fig. 3, on which the disc or diaphragm C is placed. This diaphragm is formed as usual of a thin iron plate. A lining of paper or other suitable material is placed between it and the ledge or lip, and it is held in place by two springs D, D, attached to the metal rim or ring B, with their free ends pressing upon the back of the diaphragm near its centre so as to hold it against the ledge. Thin pads of india-rubber *a*, *a*, are placed between the ends of the springs and the diaphragm. By this method of holding the diaphragm in place it is less liable to be distorted by a change of temperature than when held wholly at its circumference. The centre of the ring and diaphragm is opposite the orifice E, fig. 2, in the cover A^1, through which the sounds enter the instrument. On the other side of the diaphragm and at its centre is placed one of the electrodes. It is a small metal bar or hammer *e*, fig. 2^1, one end of which rests against the said diaphragm. The other end is brought nearly to a point and is in contact with the other electrode e^1. It is desirable that it should be formed of or plated with some metal like platinum or nickel which is not easily corroded. It may be attached directly to the diaphragm, but, as stated above, it is preferred to support it independently, as shown, upon a light spring *c*, which tends to press it away from the diaphragm and towards the opposite electrode e^1.

This method of supporting the electrode *e* ensures its contact with the other electrode under some circumstances which otherwise would be liable to separate them and break the circuit.

The electrode e^1 is fastened to a weighted spring *d*, supported on an adjusting lever F by which the tension of the spring is regulated. This spring must be stronger than the spring *c* which supports the electrode *e*, and from its greater strength it tends to keep the electrode *e* in contact with the diaphragm. It may be made of a piece of a common watch-spring, and carries at its free end a weight *g* heavy enough to check very greatly the rate of vibration of the spring. This weight may be of metal, which may serve directly as the electrode, but better results are obtained by applying to

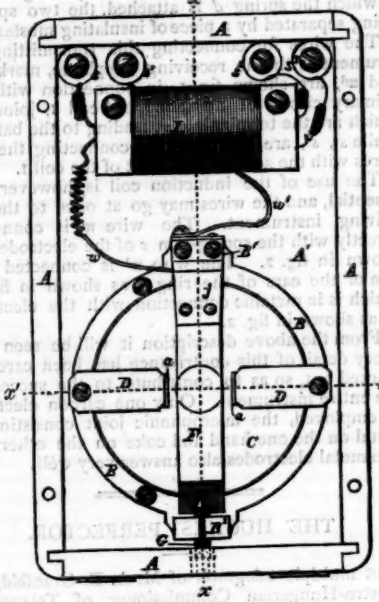


FIG. 1.

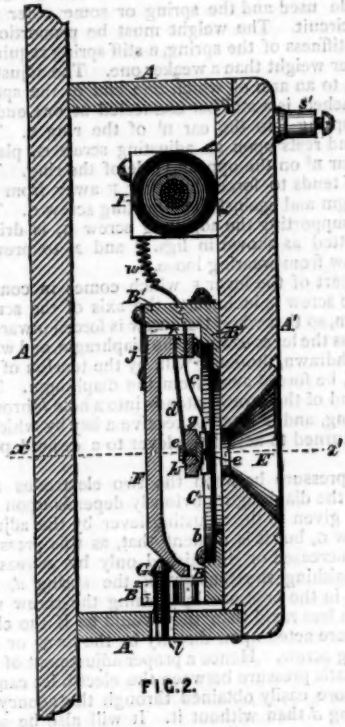


FIG. 2.

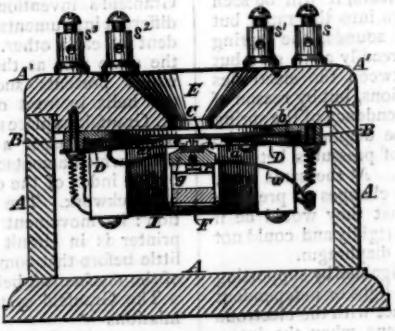


FIG. 3.

it, at the point of contact with the other electrode, a piece of gas-coke, or a hard-pressed block of carbon *h*, such as is used in electric lighting. If the weight is a non-conductor, there must be a metallic conductor between the carbon or other electrode used and the spring or some other part of the circuit. The weight must be proportioned to the stiffness of the spring, a stiff spring requiring a heavier weight than a weaker one. The adjusting lever F, to an arm of which one end of the spring *d* is attached, is a stiff bar connected at one end by a stiff spring *j* to the ear B^1 of the ring B. The other end rests upon an adjusting screw G, placed in the ear B^2 on the opposite side of the ring. The spring *j* tends to force the lever F away from the diaphragm and against the adjusting screw G. The ear B^2, supporting the adjusting screw G, is drilled and slotted as shown in figs. 1 and 2, to prevent the screw from wearing loose.

The part of the lever F which comes in contact with the screw is inclined to the axis of the screw, as shown, so that when the screw is forced inward it will press the lever towards the diaphragm, and when it is withdrawn, the lever will, by the tension of the spring *j*, be forced away from the diaphragm. The outer end of the screw extends into a hole *l* through the casing, and is fitted to receive a key by which it can be turned to adjust the lever to a desired position.

The pressure between the two electrodes and against the diaphragm obviously depends upon the position given to the adjusting lever by the adjusting screw G, but it is evident that, as this pressure can be increased or diminished only by increasing or diminishing the tension of the spring *d*, the changes in the pressure by turning the screw will be much less rapid than they would be if the electrode were acted upon directly by the lever or the adjusting screw. Hence a proper adjustment of the initial static pressure between the electrodes can be much more easily obtained through the agency of the spring *d* than without it. It will also be seen that this pressure will not be sensibly affected by any slight change in the position of the electrodes which might arise from the expansion or contraction of any part of the apparatus under a change of temperature. On the other hand, it will be seen that if the diaphragm is thrown into the rapid but slight vibrations caused by sounds, the spring alone would yield to them so readily as to give but little change of pressure between the electrodes within the range of the vibrations, but by reason of the inertia of the weight, the tendency of the spring to follow the vibrations of the diaphragm will be checked, and a greater range of pressures between the electrodes will be obtained. At the same time, it will be readily seen that the changes of pressure will be very different from what they would be if the electrodes were supported rigidly and could not yield to the movements of the diaphragm.

An additional improvement is gained by supporting that electrode on the aforesaid light or independent spring, which keeps it in contact with the electrode e^1, for it not unfrequently happens, when the intermediate electrode is attached directly to the diaphragm, that a too rapid vibration of the diaphragm, or some other disturbance in its vibrations, will throw the outer electrode out of contact with the intermediate electrode, and thus break the circuit; but in this construction such irregular vibrations of the diaphragm will separate the diaphragm from the intermediate electrode *e* rather than separate the two electrodes from each other, and the circuit will not be broken.

For convenience in construction when employing the independent spring *c* for the purpose stated, it is attached to the same arm of the adjusting lever F, to which the spring *d* is attached, the two springs being separated by a piece of insulating substance *r*.

The wires for connecting this transmitting instrument with the receiving telephone, marked *w* and w^1, are shown, fig. 1, in connection with the primary circuit of an induction coil I, joined to which are the terminals *s*, s^1, leading to the battery, while s^2, s^3, are terminals for connecting the line wires with the secondary circuit of the coil I.

The use of the induction coil is, however, not essential, and the wires may go at once to the receiving instrument. The wire *w* is connected directly with the spring-arm *c* of the electrode *e*, as shown in fig. 2. The wire w^1 is connected with one of the ears of the ring B, as shown in fig. 1, which is in metallic connection with the electrode e^1, as shown in fig. 2.

From the above description it will be seen that every detail of this contrivance has been carefully worked out, so as to contribute to the success of the entire instrument. Only one carbon electrode is employed, the microphonic joint consisting of metal on the one hand and coke on the other, but two metal electrodes also answer very well.

THE HUGHES' PERFECTOR.

THE multiple telegraph of M. A. E. Granfeld, the Austro-Hungarian Commissioner of Telegraphs, and called by him the "Hughes' Perfector," has been working since last year between Vienna and Prague.

It is a combination of the Hughes and Meyer apparatus, uniting the distributor and marking helix of the latter to the printing mechanism and corrector of the former; but the distinguishing feature of Granfeld's invention is the way in which these different instruments are kept mechanically independent of each other. The Meyer shaft placed on the same axle as the index of the distributor, and which presents successively a different part of the helix in front of each printer, is suppressed. M. Granfeld replaces it by disposing over each band of printing paper a cylinder carrying a complete helix, which a contact, made at the proper moment by the index of the distributor, throws out of gear by clockwork. The cylinder stops at each revolution: its movement commences a little before the printer is in circuit with the line, and finishes a little before that communication is broken, the play of the mechanism being regulated in consequence.

The Granfeld system comprises, for four transmissions—

1. A principal distributing apparatus.
2. Four auxiliary apparatus.

The principal apparatus or distributor is an ordinary Hughes, to which is added an index fixed to the type-wheels in such a way as to follow their movements of rotation and correction. This index turns

in front of a disc or dial of ebonite, divided into four zones, each comprising metallic pieces connected to the different organs of the system. Four rubbers fixed upon the index, at different distances from the point of rotation, traverse these zones, on which they lightly press. These rubbers, insulated from the index, are connected *two by two*, and put into connection, the first zone with the second, and the third with the fourth. This last, the fourth and most eccentric, comprises 67 contact pieces, separated by a small insulating interval, and arranged as in the Meyer distributor. The three first pieces serve for the correction, the other 64 are divided into four series of 16. The pieces of each series are connected to the "receiving relay" of an auxiliary apparatus, either directly or by the medium of the key, as will be described later on.

The third zone comprises only a circular metal piece connected directly to the wire of the line. The rubbers which travel over the two zones (the fourth and third) being united, each turn of the index puts the line in contact with the metal pieces serving for the correction, and then successively with the metal pieces connected to the diver's apparatus.

The second zone of the disc is, like the third, formed by a metal ring, and is connected to one of the poles of a local battery.

Lastly, the first zone comprises four contact pieces conveniently spaced and connected to the second pole of the local battery; an electro-magnet is intercalated between each of these pieces and this pole. These four electro-magnets are called the electro-magnetic *embrayeurs* or dislocators of the auxiliary apparatus. The position of the contact pieces of this last zone is such that the circuit local battery, including the electro-magnetic "embrayeur" of an auxiliary apparatus, is closed a little before the rubber of the fourth zone attains the series into connection with the receiving relay of the same apparatus.

Synchronism is established between the two corresponding distributing apparatus at the sending and receiving stations. At each turn of the index a current, sent automatically into the line, by one of these apparatus, traverses the electro-magnet of the second apparatus, and maintains synchronism in the same way as in the ordinary Hughes. For this purpose the three connecting plates of the distributor which should receive the current are connected to the electro-magnet of the Hughes by this distributor, and the correcting plates of the other apparatus are in communication—the middle one with the line battery, the other extreme two with the earth. A commutator permits of modifying these communications according as it is desired to give or receive correction.

Each of the auxiliary apparatus comprises a clockwork in movement during all the time of working, its speed being regulated by a vane or a vibrating stem. An electro-magnet (electro-embrayeur) placed in the circuit of the local battery connected to the first and second zone of the distributor, throws off, when the circuit is closed, an axle carrying a cylinder about four centimetres long, on the surface of which is cut in relief a helix, of which the pitch is the same length.

Like the printing axle of the Hughes, the cylinder after each revolution stops until a new current comes to put it in motion.

Under the cylinder is placed a band of paper, which is projected against the helix by a second electro-magnet (or electro-printer). This electro-magnet is acted on by a relay which receives the incoming current of the line. The signals are, as in the Meyer, printed across the paper, which advances a few millimetres the instant after the helix completes its revolution.

Each auxiliary apparatus, or printer, is furnished with a manipulating key composed of ten finger-pieces, five black for dots, and five white for dashes. Each finger-piece, like the Morse key, is made of three parts—the lever, the rest contact, and the "make" or anvil contact. The lever is connected to the line through the distributor, the rest contact to the receiving relay, and the anvil to the battery. It results from this arrangement that on pressing a finger-piece the receiving relay is insulated; but in order to record the message at the sending station, a second relay (sending relay), is intercalated between the anvil of the key and the battery. This relay, at each emission of the line current, closes, like the receiving relay, the current of a local battery acting on the electro-printer. M. Granfield has employed two relays in order to avoid difficulties of regulation in a relay working, which would require to work well with currents of two different strengths.

To sum up, each auxiliary apparatus comprises:—

1. A clockwork.
2. A sending key.
3. An electro-magnetic dislocator.
4. An electro-magnetic printer.
5. A sending relay.
6. A receiving relay.

We have seen that the fourth zone of the disc of the distributor is composed, besides three pieces for correcting, of four series of sixteen pieces, each piece of the same series being connected to the receiving relay of the auxiliary apparatus, either directly or through the key.

The details of the communications of the sixteen pieces, in the order of their traverse by the rubber, are as follows:—

The first piece is connected directly to the relay.
The second piece is connected to the lever of the first black finger-piece.
The third piece is connected to the lever of the first white finger-piece.
The fourth piece is connected to the relay.

. . . . . .
. . . . . .

The fifteenth piece is connected to the lever of the fifth white finger-piece.
The sixteenth piece is connected to the relay.

Thus, on pressing the first black finger-piece (dot) of the first auxiliary apparatus, the operator puts the second metallic piece of the first series of 16 pieces of the disc in connection with the line battery. When the rubber of the fourth zone traverses that second piece, it sends into the line a current equal in duration to that which is made to traverse it. On pressing the white finger-piece (dash), the operator puts into communication with the line battery not merely the metal piece of the disc (dash) which corresponds to that piece, but also the metal piece (dot) which corresponds to the preceding black finger-piece. This result is brought

about by a special arrangement of the manipulator already employed by M. Meyer.

At the corresponding station, the current coming from the line, arrives at the metal ring of the third zone, passes by the united rubbers to the pieces of the fourth zone, and actuates the receiving relay of the auxiliary apparatus in connection with the pieces of that last zone. The current passes from the fourth zone to the relay, either directly or through the manipulator, according as the pieces traversed during emission are connected to the relays or to the finger-pieces of the key.

Representing the time occupied by the index in making one turn round the dial or disc by T, and leaving out the pieces for correction, each series of the fourth zone will be traversed in $\frac{T}{4}$ time.

We have seen that at each auxiliary apparatus the cylinder carrying the helix was put in movement a little before the arrival of the index on the series which corresponds to it. M. Granfeld has fixed for this interval of time about $\frac{T}{8}$. The speed of the clockwork of the auxiliary apparatus is otherwise regulated so that the cylinder carrying the helix may make one revolution in $\frac{T}{2}$: this cylinder finishing its revolution $\frac{T}{8}$ after the needle has quitted the corresponding sector. Each printer is consequently ready to receive the signals intended for it during all the while the index of the distributor traverses its particular sector; variations of speed only have the effect of lengthening out or shortening the signals on the paper band.

For these auxiliary apparatus M. Granfeld has utilised certain Hughes' movements, which he has modified in such a way that at each unlockage a special shaft, carrying the cylinder, makes a revolution in about $\frac{1}{4}$ second, the index of the regulator traversing the dial in about $\frac{3}{4}$ second.

The Granfeld apparatus working between Vienna and Prague has given good results, with a speed of 88 turns of the regulator per minute, giving $(88 \times 4 \times 60) = 21{,}120$ letters, or a mean of 3,520 words per hour. By suppressing the fifteenth white and black finger-pieces, it would be possible to serve five apparatus instead of four, and increase the total efficiency in proportion.

It should be added that, by an easy manœuvre, the operator can raise the disc placed in front of the index, and utilise the principal apparatus as an ordinary Hughes. — SAMBOURG in the *Annales Télégraphiques*.

THE TELEGRAPH IN CHINA.

THE line from Tientsin to Taku, a distance of some forty miles, was opened for the transmission of public messages on June first. The line was erected by the students of the Imperial Torpedo College, of which Mr. J. A. Betts, M.S.T.E., is Director. The working staff, both engineering and commercial, is entirely Chinese. Direct working Morse instruments are employed, and a fair amount of business is being done, the receipts for the first month exceeding the estimated amount. The charge for a message of ten words is fixed at one dollar. Messages may be written in either English or Chinese. Not the slightest opposition has been offered by the people to the erection or working of the line, although it passes through the neighbourhood of several camps of turbulent soldiery. The thanks of the foreign community are largely due to H. E. Di Hung Chang for his enlightened policy in throwing the line open, and thus setting the example of erecting the first public telegraph line in China built and maintained by Chinese. It speaks something also for the success of Mr. Betts' experiment that, in the short space of three years, he has been able to educate an efficient staff of telegraphists in addition to the chief work of the college—viz., torpedo engineering.

THE BELGIAN TELEGRAPH SERVICE.

FROM the report of the Director-General on the telegraph service of Belgium for the year 1878, we learn that for several years the increase of telegraphic correspondence in Belgium has been almost arrested. In 1877, for the first time, the number of private messages fell below that of the preceding year, and although the results for 1878 exceed even those of 1876, there are as yet no signs of the revival of trade from which much is expected.

Out of 1,966,473 messages exchanged between Belgian offices during the year there were 55,326 "urgent" messages, 74 repeated messages, and 122 acknowledgments of receipt. "Urgent" telegrams, securing priority of transmission by means of a higher charge, have been accepted in Belgium for twenty-three years without causing any objection or inconvenience whatever. The charge for urgency was at first fixed at three times the ordinary rate. It was afterward thought prudent to charge a quadruple rate, but in 1869, after three years' experience, it was found possible to transmit these messages at double the ordinary charge. The double rate is obligatory for telegrams handed in after nine in the evening for transmission during the night, 7,529 out of 55,326 "urgent" messages being thus charged. This class of telegrams during the day comprises but 2½ per cent. of the whole traffic, which small proportion is explained by the nearness of the towns to each other, the large number of railway lines, the rapidity of the postal communications, and the large number of deliveries.

About half of the urgent messages sent occupy less than ten minutes in transit between the sender and receiver, a large number of these telegrams being exchanged between the Brussels and Antwerp bourses at hours when the correspondents are within a few steps of the instruments. This instance shows the practical utility of priority in virtue of the higher charge. If the correspondents who direct their operations by means of questions and replies exchanged in ten minutes had to wait their turn, they would often be unable to avail themselves of the telegraph. This deprivation would not profit any one, for, in the proportion in which they exist, "urgent" messages do not cause an appreciable delay to the ordinary correspondence. Repetitions can be obtained for 25 centimes—5 cents—and it is a striking proof of the accuracy of the service that it is only demanded once for every 40,000 messages. It is very rare that a despatch is completely lost in course of transmission. Nevertheless, this does occasionally happen, and no telegraphic service can offer absolute guarantee against non-delivery from this cause. The only safeguard lies in the acknowledgment of receipt.

Although in Belgium this costs half a franc—twice as much as repetition up to thirty words—it is demanded six times in 100,000 messages—no doubt as much as a check upon the correspondent as upon a telegraph service.

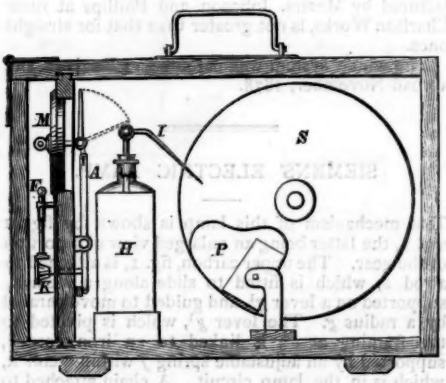
Telegraphic remittances, at charge of 1f.—20 cents—acknowledgment of receipt included, in addition to the postal rate, numbered 14,846 during 1878.

In the four principal cities (Brussels, Antwerp, Ghent and Liege) a letter or post-card bearing, in addition to the postage stamp, a five cent telegraph stamp, is delivered express by means of the service of messengers organized for the distribution of telegrams. This service is conducted in a certain number of fixed posts connected by tramways. The letters and cards are received at all postal and telegraph offices, and may be deposited in special boxes provided on the cars. This service dealt with 51,285 letters and 48,467 post-cards in 1878, the receipts to the credit of the Telegraph Department being 24,938f.—about 4,900 dollars.

On December 31st last, Belgium had 648 offices, and worked 1,161 instruments. The Morse instrument is in general use in all the offices, with the addition in the principal towns of the Hughes printer. A few offices work the A B C instrument. There are 1,143 Morse, 48 Hughes, and 10 A B C instruments in use. The total number of persons employed in the telegraph service was 3,685.

AN ELECTRIC EXPLODER.

MANY practical men, even intelligent ones, wrongly suppose that it is necessary to employ dynamic electricity for all the great effects of modern industry. It will not be out of place to show that frictional electricity can be usefully employed in

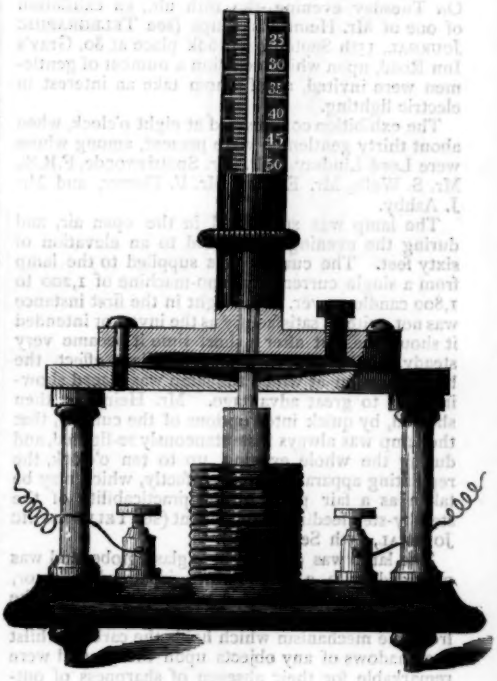


many cases, and that the works of old electricians—those fathers of a science so grand and so progressive—have not been set aside by the most marvellous progress that history can record. One of the best ways to fire fuses in mines, in which the explosive material is the dynamite of Nobel, is by means of the apparatus of M. Vian, 12, Rue Condonet. This arrangement is formed of two discs of resin, to which are given a rotatory movement by means of a handle. These discs, S, in their movement of rotation, rub between cushions covered with cat-skin, P.

The electricity thus developed is taken off by the point I, which communicates with the interior of a Leyden jar, which acts as a condenser. The exterior coating H of the jar is connected with the point situated at a distance at which the spark is to be produced. But a difficulty arises in the employment of this apparatus. The discharge which is produced is scarcely ever complete; it remains on the two surfaces of the Leyden jar; in other words, it is a residual charge. The parts shown on the left of the figure form the discharger, the object of which is to cause a spark to jump between the metallic pieces F and M. This result is obtained by pressing the button K, so that the movable lever which terminates the part A comes into contact with the knob of the Leyden jar.—*L'Électricité.*

HOPKINS' ELECTRIC CURRENT MEASURER.

THIS instrument, devised by Mr. G. M. Hopkins of the United States, America, is shown by the figure. It consists of a vulcanite chamber, to which



is fixed a glass tube of small calibre; a steel diaphragm runs across the chamber, and the space above it is filled with mercury.

A vulcanite screw at the top of the chamber

serves to adjust the height of the mercury in the tube. The graduations on the scale at the side of the tube represent the number of pounds of attractive force exerted on the instrument. The graduations from zero upward indicate the degree of upward pressure when the force of repulsion is measured.

A short rod is attached to the middle of the diaphragm, and projects downward through a hole in the base plate to receive a cylindrical armature or core which extends into a helix.

The diameter of the diaphragm is 2 inches; the calibre of the glass tube, 0·2 inch; therefore a very slight motion of the diaphragm is indicated by a considerable movement of the mercury in the tube.

When the repelling force of a magnet is to be exhibited the soft iron armature is replaced by a permanent magnet.

The instrument shown by the fig. may be placed anywhere in a circuit, and will indicate the strength of the current. An increase in electro-motive force results in the drawing in of the iron core and a consequent deflection of the diaphragm and movement of the mercury column.

HEINRICHS' ELECTRIC LAMP.

ON Tuesday evening, the 16th ult., an exhibition of one of Mr. Heinrichs' lamps (see TELEGRAPHIC JOURNAL, 15th September) took place at 80, Gray's Inn Road, upon which occasion a number of gentlemen were invited, all of whom take an interest in electric lighting.

The exhibition commenced at eight o'clock, when about thirty gentlemen were present, among whom were Lord Lindsay, M.P., Mr. Spottiswoode, F.R.S., Mr. S. Wells, Mr. E. Cox, Mr. F. Flower, and Mr. J. Ashby.

The lamp was suspended in the open air, and during the evening was raised to an elevation of sixty feet. The current was supplied to the lamp from a single current dynamo-machine of 1,200 to 1,800 candle power. The light in the first instance was not quite as satisfactory as the inventor intended it should be, but after a short time it became very steady, and produced a most brilliant effect, the high elevation at which the lamp was placed showing this to great advantage. Mr. Heinrichs then showed, by quick interruptions of the current, that the lamp was always instantaneously re-lighted, and during the whole evening, up to ten o'clock, the regulating apparatus acted perfectly, which may be taken as a fair proof of the practicability of the step-by-step feeding arrangement (see TELEGRAPHIC JOURNAL, 15th September).

The lamp was covered by a glass globe, and was provided with a large white japanned reflector, 36 inches in diameter. A noticeable point in the illumination was the absence of the usual shadows from the mechanism which holds the carbon, whilst the shadows of any objects upon the ground were remarkable for their absence of sharpness of outline.

All the visitors seemed to be very much satisfied with the favourable results obtained with this new lamp, which prognosticated for the system an extensive employment.

There has been a great want of a simple form of electric lamp for lighting up railway stations, churches, or large public halls, which will burn steadily for a long period, and as the Heinrichs' lamp will last for ten to twenty-four hours, without change of carbons, it may prove a dangerous competitor to other systems in use.

Mr. Heinrichs also showed his new electric-motor, which gave most favourable results as a transmitter of power, and which we hope to describe in detail at some future time; at present we will give only a few notes of the results obtained with this motor during the evening.

The current of a Gramme machine driven at 850 revolutions per minute by 1½ to 2 horse-power, was connected by sixty yards of cable to Heinrichs' electric-motor. The revolving armature of this motor weighs over forty pounds, and was driven by the current at a rate of 1,600 revolutions per minute. The motor was then connected by a belt to a grindstone 30 inches in diameter and 4 inches wide; the grindstone was then driven by the motor at a speed of from 230 to 250 revolutions per minute, whilst the motor kept up a speed of 1,100 revolutions per minute. When rough work was put in operation upon the grindstone the speed of the latter was but little reduced. It is stated that the loss of power in this motor, worked by a dynamo-machine at a distance of 60 to 100 yards, was not 20 per cent.

Mr. Heinrichs promises to have in a short time a new single current dynamo-machine for light purposes, and will then be able to give more exact figures as to the illuminating power of his light and how much power is lost by the transmission of power by his new electric-motor, which must be very favourable according to the results obtained.

We are informed by Mr. Heinrichs that the expense of the circular carbons, which were manufactured by Messrs. Johnson and Phillips at their Charlton Works, is not greater than that for straight ones.

The whole system was patented in England and abroad November, 1878.

SIEMENS' ELECTRIC LAMP.

THE mechanism of this lamp is shown by figs. 1 and 2, the latter being an enlarged view of a portion of the gear. The upper carbon, fig. 1, is attached to a rod S, which is fitted to slide along a stem A, supported on a lever g^1, and guided to move parallel by a radius g. The lever g^1, which is pivoted to the framing at o^1, is linked to an iron core E, supported by an adjustable spring f within a coil R, which is in the lamp circuit. A chain attached to the lower end of the slide S passes over a wheel r, having teeth to engage its successive links. The wheel r is mounted on the stem A, and is prevented from turning by a pawl z catching in the teeth of a ratchet wheel on the axis of r. So long as z remains engaged with these teeth, the slide S and the stem A remain firmly connected, both moving together in obedience to the movements of the core E, which rises as the electrical force increases, and descends as it diminishes. By these movements

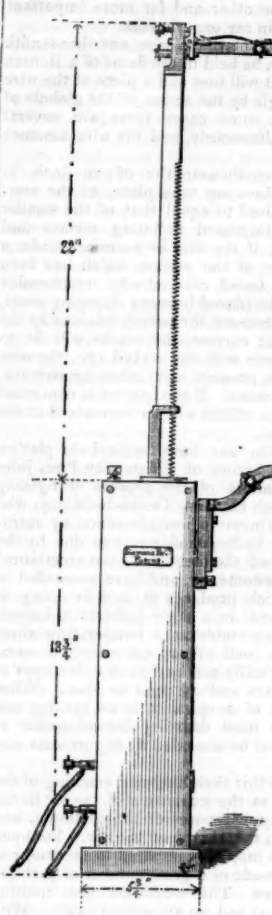


FIG. 3.

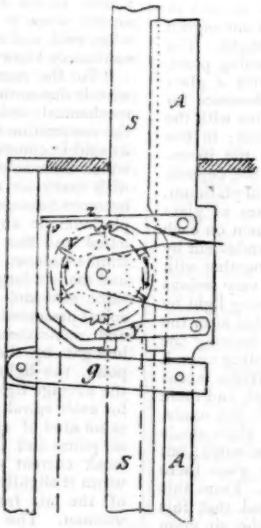


FIG. 2.

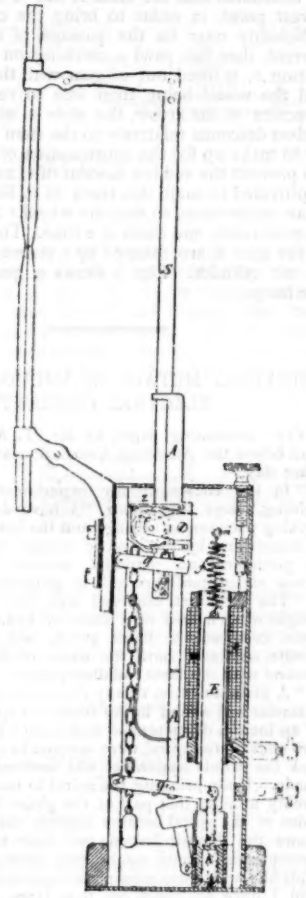


FIG. 1.

the distance of the carbon points is automatically adjusted. When, however, the carbons become so far consumed that the stem A has to descend to its lowest point, in order to bring the carbon points sufficiently near for the passage of the electrical current, then the pawl *z*, catching on a fixed projection *v*, is lifted out of gear with the teeth of *r*, and the wheel being then free to revolve in the direction of the arrow, the slide S with the upper carbon descends relatively to the stem A sufficiently far to make up for the consumption of the carbons. To prevent the sudden descent of S, another pawl *y* is provided to catch the teeth of *r*, like the anchor of an escapement, so that the wheel *r* can only turn intermittently one tooth at a time. The movements of the core E are damped by a piston *x* working in an air cylinder. Fig. 3 shows a general view of the lamp.

HEATING METALS IN VACUO BY THE ELECTRIC CURRENT.

A VERY interesting paper, by Mr. T. A. Edison, was read before the American Association at Saratoga the other day:

"In the course of my experiments on electric lighting," says the author, "I have developed some striking phenomena arising from the heating of metals by flames and by the electric current, especially wires of platinum and platinum alloyed with iridium. These experiments are still in progress.

"The first fact observed was that platinum lost weight when heated in a flame of hydrogen, that the metal coloured the flame green, and that these two results continued until the whole of the platinum in contact with the flame had disappeared.

"A platinum wire, twenty-thousandths of an inch in diameter was wound in the form of a spiral one-eighth of an inch in diameter and half an inch in length. The two ends of the spiral were secured to clamping posts, and the whole apparatus was covered with a glass shade. Upon bringing the spiral to incandescence for twenty minutes that part of the globe in line with the sides of the spiral became slightly darkened; in five hours the deposit became so thick that the incandescent spiral could not be seen through the deposit. This film, which was most perfect, consisted of platinum, and I have no doubt but that large plates of glass might be coated economically by placing them on each side of a large sheet of platinum, kept incandescent by the electric current. This loss in weight, together with the deposit upon the glass, presented a very serious obstacle to the use of metallic wires for giving light by incandescence, but this was easily surmounted after the cause was ascertained. I coated the wire forming the spiral with the oxide of magnesium by dusting upon it finely powdered acetate of magnesium. While incandescent the salt was decomposed by the heat, and there remained a strongly adherent coating of the oxide. This spiral so coated was covered with a glass shade and brought to incandescence for several minutes; but instead of a deposit of platinum upon the glass there was a deposit of the oxide of magnesia. From this and other experiments I became convinced that this effect was due to the washing action of the air upon the spiral; that the loss of weight in and the colouration of the hydrogen flame was also due to the wearing away of the surface of the platina by the attrition produced by the impact of the stream of gases upon the highly incandescent surface, and not to volatilisation, as commonly understood.

"I will now describe other and far more important phenomena observed in my experiments.

"If a short length of platinum wire, one-thousandth of an inch in diameter, be held in the flame of a Bunsen burner, at some part it will fuse and a piece of the wire will be bent at an angle by the action of the globule of melted platinum; in some cases there are several globules formed simultaneously, and the wire assumes a zigzag shape.

"With a wire four-thousandths of an inch in diameter this effect does not take place, as the temperature cannot be raised to equal that of the smaller wire owing to the increased radiating surface and mass. After heating, if the wire be examined under a microscope, that part of the surface which has been incandescent will be found covered with innumerable cracks. If the wire be placed between clamping posts, and heated to incandescence for twenty minutes by the passage of an electric current, the cracks will be so enlarged as to be seen with the naked eye, the wire under the microscope presents a shrunken appearance, and is full of deep cracks. If the current is continued for several hours these effects will so increase that the wire will fall to pieces.

"This disintegration has been noticed in platina long subjected to the action of a flame, by Prof. John W. Draper. The failure of the process of lighting invented by the French chemist, Tessié-du-Motay, who raised sheets of platinum to incandescence by introducing them into a hydrogen flame, was due to the rapid disintegration of the metal. I have ascertained the cause of this phenomenon, and have succeeded in eliminating that which produces it, and in doing so have produced a metal in a state hitherto unknown, and which is absolutely stable at a temperature where nearly all substances melt or are consumed, a metal which, although originally soft and pliable, becomes as homogeneous as glass and as rigid as steel. When wound in the form of a spiral it is as springy and elastic when at the most dazzling incandescence as when cold, and cannot be annealed by any process now commonly known.

"For the cause of this shrinking and cracking of the wire is due entirely to the expansion of the air in the mechanical and physical pores of the platinum, and the contraction upon the escape of the air. Platinum as sold in commerce may be compared to sandstone in which the whole is made of a great number of particles with many air spaces. The sandstone upon melting becomes homogeneous and no air spaces exist. With platinum or any metal the air spaces may be eliminated and the metal made homogeneous by a very simple process. This process I will now describe. I had made a large number of platinum spirals, all of the same size and from the same quality of wire; each spiral presented to the air a radiating surface of three and one-sixteenth of an inch; five of these were brought by the electric current up to the melting point, the light was measured by a photometer, and the average light was equal to four standard candles for each spiral just at the melting point. One of the same kind of spirals was placed in the receiver of an air pump and the air exhausted to two millimetres; a weak current was then passed through the wire to warm it slightly for the purpose of assisting the passage of the air from the pores of the metal into the vacuum. The temperature of the wire was gradually augmented at intervals of ten minutes until it became red. The object of slowly increasing the temperature was to allow the air to pass out gradually and not explosively. Afterward the current was increased at

intervals of fifteen minutes. Before each increase in the current the wire was allowed to cool, and the contraction and expansion at these high temperatures caused the wire to weld together at the points previously containing air. In one hour and forty minutes this spiral had reached such a temperature without melting that it was giving a light of twenty-five standard candles, whereas it would undoubtedly have melted before it gave a light of five candles had it not been put through the above process. Several more spirals were afterward tried, with the same result. One spiral which had been brought to these high temperatures more slowly gave a light equal to thirty standard candles. In the open air this spiral gave nearly the same light, although it required more current to keep it at the same temperature.

"Upon examination of these spirals, which had passed through the vacuum process, by the aid of a microscope, no cracks were visible; the wire had become as white as silver, and had a polish which could not be given it by any other means. The wire had a smaller diameter than before treatment, and it was exceedingly difficult to melt in the oxyhydrogen flame, as compared with untreated platinum; it was found that it was as hard as the steel wire used in pianos, and that it could not be annealed at any temperature.

"My experiments with many metals treated by this process have proved to my satisfaction, and I have no hesitation in stating, that what is known as annealing of metals to make them soft and pliable is nothing more than the cracking of the metal. In every case where a hard drawn wire had been annealed a powerful microscope revealed myriads of cracks in the metal.

"Since the experiments of which I have just spoken, I have, by the aid of Sprengel mercury pumps, produced higher exhaustions, and have, by consuming five hours in excluding the air from the wire and intermitting the current a great number of times, succeeded in obtaining a light of eight standard candles from a spiral of wire with a total radiating surface of 1-32 of an inch, or a surface about equal to a grain of buckwheat.

"With spirals of this small size which have not passed through the process the average amount of light given out before melting is less than one standard candle. Thus I am enabled by the increased capacity of platinum to withstand high temperatures, to employ small radiating surfaces, and thus reduce the energy required for candle-light. I can now obtain eight separate jets, each giving out an absolutely steady light, and each equal to sixteen standard candles, or a total of one hundred and twenty-eight candles, by the expenditure of thirty thousand foot pounds of energy, or less than one horse-power.

"As a matter of curiosity I have made spirals of other metals, and excluded the air from them in the manner stated. Common iron wire may be made to give a light greater than platinum not heated. The iron becomes as hard as steel and just as elastic. Nickel is far more refractory than iron. Steel wire used in pianos becomes decarbonised, but remains hard and assumes the colour of silver. Aluminium melts only at a white heat."

A LIQUID RHEOSTAT.

By F. J. SMITH.

WHILE experimenting on resistance to the electric current I have devised an instrument in which fluid is used to conduct the current under examination. This may perhaps be of use to some who are working in the same direction. The sketch (fig. 1) shows the nature of the instrument.

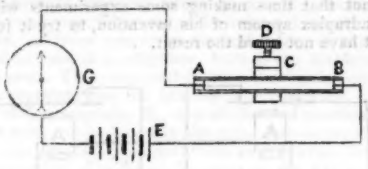


FIG. 1.

A B is a piece of elastic tube containing a weak solution of salt in water, this is held in the clamp, C. By the screw, D, the tube can be compressed and its sectional area altered, and through this its resistance. G is the galvanometer and E the battery. Finding the instrument to be very sensitive on a reflecting galvanometer, I thought that probably the tube would be a means of transmitting articulate speech. I find this to be the case. In fig. 2, A B is

FIG. 2.

an elastic tube similar to the one used in the former instrument. C C mouth-piece, with disc connected to the tube at E. A B is put in circuit with a telephone and battery. D, screw to regulate the pressure on the tube.

Correspondence.

DUPLEX TELEGRAPHY.

To the Editor of THE TELEGRAPHIC JOURNAL.

DEAR SIR,—I have read with much interest the discussion in your paper on the possibility of working Duplex without the employment of condensers.

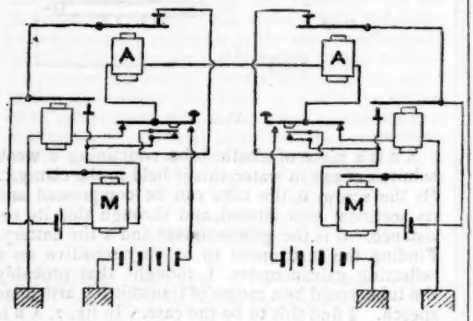
It should, certainly, be possible to re-produce by mechanical means a signal which should exactly counteract and neutralise the effect of the sending current in the relay, or other instrument employed for the reception of signals.

The rate of magnetisation of similar electro-magnets in circuits of equal resistance, is much modified by a slight inequality in the electro-static capacities of the two conductors.

That of an artificial resistance of fine wire would be very small compared with almost any line of telegraph, and the latter would, in consequence, reduce the potential of the battery in a greater ratio than the other at the instant of making battery contact, therefore, a compensating condenser is usually applied to the artificial line.

To produce the required effect without condensers, I devised the following arrangement, and although the Messrs. Theiler, in their letter, do not mention the suggestion of any plan prior to their own, they were acquainted with the above, which I explained to them

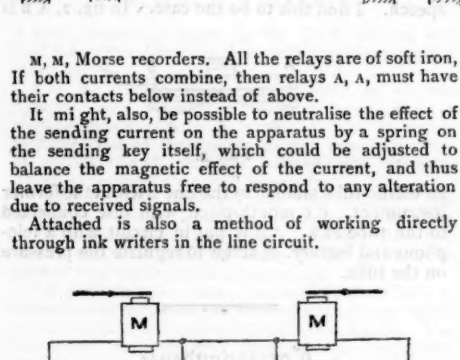
when endeavouring to borrow two Morse keys, with suitable contacts, to make a trial. They were, however, unable to lend me such a key, and I requested Mr. Ash, of the Eastern Telegraph Company, who was about that time making some experiments with the quadruplex system of his invention, to try it for me; but have not heard the result.



M, M, Morse recorders. All the relays are of soft iron, If both currents combine, then relays A, A, must have their contacts below instead of above.

It might, also, be possible to neutralise the effect of the sending current on the apparatus by a spring on the sending key itself, which could be adjusted to balance the magnetic effect of the current, and thus leave the apparatus free to respond to any alteration due to received signals.

Attached is also a method of working directly through ink writers in the line circuit.



M, M, Morse recorders. Relays A, A, are adjusted so as not to respond to the sending current until reinforced by the received current.

Yours truly,
F. HIGGINS.

The Exchange Telegraph Company,
Limited, London, E.C.

DEAR SIR,—In his letter, which you publish in your last issue, Mr. Rapieff points out the danger of patenting too much at one time. In his voluminous 1877 patent of 42 pages, 13 sheets with 112 illustrations, and 24 claims, he appears to patent all things electric, magnetic, and otherwise, and amongst them the Gramme Ring and the Siemens-Alteneck Cylinder Helix, which brightly shone in competition at the Vienna Exhibition in the year of our Lord 1873.

I fail to find from out of the labyrinth of sketches, even on sheet 6, anything coinciding with the Siemens-Alteneck Alternating Current Machine as described in your issue of 1st inst.

I am, dear sir,
Yours faithfully,
G. RISCH.

Lansdowne Road, Old Charlton,
Sept. 24th, 1879.

Notes.

ANDRÉ'S ELECTRIC MINING LAMP.—A few days since the Duke of Sutherland, Professor Keates, Chemist to the Metropolitan Board of Works, Mr. Easton, C.E., and a number of gentlemen attended at the offices of the British Electric Light Company in Parliament-street, to witness George E. André's electric mining lamp in operation. Mr. André gave an explanation of the lamp and its working, and showed its adaptability to the lighting of fiery collieries and mines generally. The atmosphere being securely excluded from the light, the risk of explosion, with its fearfully disastrous effects, is entirely avoided, and this is attained advantageously and economically, for the light emitted is of great power, and the cost far less than that of safety lamps or candles. The Duke, on taking leave of Mr. André, expressed his satisfaction at the success attained, and remarked that the lamp had a great future before it. The lamp exhibited will burn six hundred hours in a mine without being touched, four carbons being thrown into light automatically one after another.

THE ELECTRIC LIGHT AND GEMS.—Mr. Frank Flower, diamond merchant, Piccadilly, has published a small pamphlet on "Electricity as an Agent in the Household," in which he states that he has completed a standard electric clock which goes correctly by means of three cells. He also employs the electric light to illuminate his shop window, as he finds that it in no way alters the colour of gems. A diamond that is decidedly "off colour" will under ordinary gas-light pass as a white stone, and, in fact, is often more brilliant than one purely white; but not so under the electric light, by which the most ignorant could detect the light straw shade which is, for example, so familiar to us in the Cape diamonds. This advantage of the electric light will therefore be felt both by the public and the diamond merchant, who will be able to do business after nightfall.

JABLOCHKOFF'S electric light is about to be introduced into Teheran.

RESISTANCE OF THE ELECTRIC ARC.—Professors Houston and Thompson have arrived at the conclusion that within certain conditions the relation between current strength and arc resistance may be defined as follows:—1. In arcs of equal lengths the resistances are inversely proportional to the current strengths. 2. The illuminating power of an arc is approximately proportional to the current traversing it. 3. In arcs of equal lengths the total energy given out is proportional to the current strength. Details of the investigation are given in the August number of the *Journal of the Franklin Institute*.

RANGE OF THE ELECTRIC BEAM.—On the evening of July 12, the Maxim electric light was put in operation on the tower of the Grand Union Hotel, Saratoga Springs, New York, with a view to test the extent of its illuminating powers. An open parabolic reflector was used—no lenses—and care was taken by Mr. Maxim to set the points of the carbons a little at one side of each other, and to adjust them to the exact focus of the reflector. When this was fairly accomplished, the light was turned toward a spot in Ballston Spa, New York, 7½ miles distant, where, by previous arrangement, a group of several hundred persons were assembled to witness the experiment. So powerful was the light, so accurate the focusing and alignment, that the designated place in Ballston was instantly illuminated, so that ordinary print could be read, the time seen on watches, etc. The night was clear, still, and dark. The experiment was made at half-past nine o'clock p.m. This is believed to be the greatest distance at which illumination of equal degree has been accomplished

WE hear that the representatives in Paris of the Werdermann system of electric lighting have succeeded in producing from an A Gramme machine, driven by a five horse-power gas engine, ten lights in circuit of 225 candle-power each. The machine being arranged for *intensity* instead of quantity.

ELECTROMOTIVE FORCE OF THE VOLTAIC ARC.—M. Latschinoff, of St. Petersburg, from a number of experiments has been led to conclude, with Herr Edlund, that an electromotive force of polarisation is produced in the voltaic arc. With a battery of 40 Bunsen elements, giving a current of 95 electromagnetic units, that polarisation is nearly equal to 12 Bunsen elements. The introduction of a little sodium or potassium in the arc, produces almost 50 per cent. diminution of the polarisation, and increases the length of the arc.

REYNIER'S NEW LAMP.—M. Reynier, the ingenious young French electrician who brought out the first incandescent carbon lamp, has added another improvement to the older forms. This consists in limiting the incandescent portion of the smaller electrode which impinges upon the thicker one to a certain fixed length. He does this by the use of a third lateral electrode touching the smaller one at the point which is meant to band the heated length. The current enters the smaller electrode by the lateral one, and passes on through the incandescent point of the former to the thick electrode.

PREACHING BY TELEPHONE.—Another remarkable success has just been achieved by means of the patent microphone of Mr. Louis J. Crossley, of Halifax. On Sunday, September 14, the divine service held in the Square Congregational Chapel, Halifax, was transmitted to Bradford, Saltaire, and Milner Field, a distance of 17 miles. The transmitting microphone was placed on the pulpit at a distance of three feet from the preacher, the Rev. Dr. Mellor, and there were five listening stations in circuit comprising twelve telephones. Notwithstanding the fact that the wire between Bradford and Saltaire ran beside other lines busily working, the service in the chapel was heard with great clearness; and the *Te Deum* produced a fine effect on the distant hearers. We do not know what the text happened to be, but no more appropriate one could have been found in the whole Bible than this, "His word is nigh unto thee, His word runneth swiftly."

THE TELEPHONE SYREN.—The air syren of Cagmard de la Tour, which is familiar to all who have studied acoustic science, has been imitated in Germany by means of a speaking telephone circuit. A circular disc having small bar magnets arranged on its face radially, or from centre to circumference, is rapidly rotated in front of a telephone, having the diaphragm withdrawn. This dismantled telephone is in circuit with a complete one for hearing in. When the same poles of the magnets, N., are all directed outwards, a certain note can be heard in the latter telephone; if the poles alternate N.S., the lower octave is heard. When the succession of poles at the edge of the disc is, say N.N.S., there are heard three tones; one corresponding to the interval N.N., one an octave lower, corresponding to N.S.N., and a third combination tone of three tunes, the tune of vibration of the highest, corresponding to the return, each time, of the first N. The vibration numbers are thus as 3, 2, 1. In this way, by arranging the magnets on the disc, a diversity of tones can be obtained.

ELECTRICITY AND BEE-REARING.—A correspondent of the *Deutsche Presse* describes a method, which he has adopted with success, of overcoming the obstacles frequently presented to the rearer of bees by the self-will of those interesting and profitable insects. This is no other than giving them an electric shock. Every one interested in bees knows the difficulties and dangers involved in hiving a swarm. One is often seen on a hot day in June in the top branches of a tree not to be climbed, and another in some inaccessible place seems to be preparing to set out on its wanderings. If the beemaster venture to approach, all his dexterity and experience will often not prevent him from being seriously stung. There are, indeed, several cases on record of death supervening from the stings inflicted on such occasions. Herr Freiwirth, the correspondent referred to, hit upon the idea of employing the electric force to stupefy the bees. Trials on large and small clusters, and even on single insects, answered perfectly: the bees coming in contact with the conducting wires fell stunned and motionless to the ground. They were then sorted and marked, according to the strength of the current applied. The time required for their recovery, varying from ten minutes to eight hours, was proportionate to the strength of the shock, but all came out of their trance safe and sound. Encouraged by the result of this experiment, Herr Freiwirth resolved to try it on a larger scale, namely, on bees in the hive. To this end, he introduced the ends of two conducting wires into a fully occupied honeycomb, and turned on the current for a moment; the bees soon lay on the ground, and it was half an hour before they resumed activity. Herr Freiwirth then constructed an apparatus in a small box, six inches each way, which, similar to a cartridge pouch, he wore with a strap round his body. The two wires of the apparatus were, when required to be used, fastened to rods of a suitable length, the wires of course always projecting over the ends of the rods. These ends were then applied to the swarm, a knob similar to that employed for a room-telegraph being attached to the apparatus, that the current might be turned on at the proper time.

RAILWAY PASSENGERS will hail with satisfaction an invention calculated to add greatly to their convenience and comfort (which has just been provisionally patented by Mr. F. M. Rogers, engineer, of 29, Moorgate Station Buildings, London), by which they may know with certainty the station the train is about to enter. The means by which this is accomplished is very simple. In each compartment there is a dial resembling the

face of a clock, upon which is painted the names of the stations on the route. A hand or pointer connected with an electrical arrangement being caused to move round the dial when a current passes through the instrument, which current is automatically sent in this way:—Upon the other side of the step-board of the first carriage composing the train is pivoted a small arm connected with a battery or other source of electricity, and as the train enters the station this arm strikes against a peg inserted under the edge of the platform. The arm is thus pressed back, and a current is sent through the wire and indicators causing the pointers to show the station reached. The arrangement described is admirably adapted for the metropolitan lines, where the carriages are permanently coupled, and constantly travel the same road. Where carriages are separated, and for long journeys, a modification is necessary. As the proposed system is simple in action, and inexpensive in application, there is no reason why it should not soon come into extensive use. The name of the station being shown in the compartment of the railway carriage, it is to be hoped that ere long the indistinct calling of porters, and the confusion and uncertainty frequently witnessed at stations, may become things of the past.

ST. ELMO'S FIRE appears to have been unusually frequent in the Alps of late. In our last issue we chronicled the illumination of an entire pine forest by the silent discharge; and more recent reports announce another display on the Gross Glockner Mountain, where some Alpine tourists were willy-nilly forced to play a part as fiery demons in the "Walpurgis-nacht." Nature, says one of these impressed imps, was lit up as if by a vast conflagration; we were clad as in a garment of lightning, and the thunder rolled with deafening din, and was repeated in stunning echoes from every crag, while the gale sent piercing whistles from the narrow fissures. All six were temporarily blinded by the glare of electricity, and when they recovered the use of their eyes, to their astonishment,

> Sudden, breaking in their raptured sight,
> Appeared the splendour of St. Elmo's light.

Hair and beards, hats and coats, emitted electric sparks, and from the very cords attaching their head coverings to their lappels, and from the tops of their alpenstocks streamed the electric fluid. This play of flitting phosphorescence and golden corruscation on the lone background of eternal snows was very picturesque.

THE new American Union Telegraph Company has been interdicted from running wires on government poles through Philadelphia, at the instance of the Western Union Company, on plea that the American Union was violating a city ordinance. The American Union had, however, first obtained the consent of the secretary of the navy. The fact that two poles of the American Union line have been cut down is also causing some scandal in America like that which was raised concerning the breaks in the Direct United States Cable, before it was taken over by the Anglo-American Company. The American Union Company is expected to open for business on October 1, with offices in all the chief cities east of Chicago.

ELECTRIC UNITS.—Professor Everett's handy little volume on "Units and Physical Constants" (Macmillan and Co.), has just entered a second edition, which contains additional explanations on points of theory, and other improvements. The book has already made good its title to the use of all students of science, and the electrician will find in it his own new-fangled and puzzling units admirably expressed.

THE CAPE CABLE.—The s.s. *Seine* reached Aden on September 17th, on her return from having completed the Mozambique and Delgoa Bay section of the Cape Cable, thus completing the line of telegraphic communication from Natal to Mozambique. It is believed that the other section, from Mozambique to Zanzibar, would be finished by September 20th. When this has been done, a voyage of nine days will still be necessary to convey messages from Zanzibar to Aden. It is worthy of note that the news from Natal to England which handselled the cable just laid was the announcement of Ketchwayo's capture.

FOREIGN ITEMS.—The German underground telegraphs, connecting all the forts with Berlin, will be completed next year. A telegraph party in the Shaturgardan Pass, Afghanistan, has been attacked by Ghilzais, and 20 workmen killed. The Russian field telegraphs in Central Asia have been repeatedly cut by Turcomans. The Cuban rebels have interrupted the telegraphic communication between Holquin and Santiago.

THE TRANSFORMATION OF SOUND INTO LIGHT.—We drew attention in a recent note to the re-invention of the phoneidoscope of Mr. Henry Edmunds, by a French *savant*, M. Raimond Coulon, Conservator of the Industrial Museum at Rouen, and have since received the assurance of that gentleman that he had no knowledge whatever that any one had been working on the same subject with like results. The phoneidoscope was first exhibited at Mr. Preece's lecture on the telephone last winter at the Royal Institution.

THE British Association have granted £20 to Prof. W. E. Ayrton for the furtherance of his researches on the Specific Inductive Capacity of the Sprengel Vacuum. The same amount has been allotted to Professor W. G. Adams, for a standard of white light. Sir William Thomson also received a similar sum for experiments on the elasticity of wires.

A CONVENTION concluded between the Governments of England and France fixes the rate of charge for telegraphic messages between the two countries at 20c. per word. Negotiations have also been commenced with Spain, Italy, Switzerland, and Belgium for the establishment of a fixed telegraphic tariff.

ELECTRO-OPTISM OF LIQUIDS.—The principal results of Dr. J. Kerr's electro-optic experiments on liquids are stated by him as follows:—When an insulating liquid is traversed by electrostatic force, it exerts a purely birefringent action upon transmitted light. In relation to this action, liquids are devisible into two classes, the positive and the negative. Positive liquids act as glass extended in a direction parallel to the lines of electric force, or as plates of quartz or other positive uniaxals, with axes parallel to the lines of force. Carbon disulphide is the best example. Negative liquids act as glass compressed in a direction parallel to the lines of force, or as plates of Iceland spar or other negative uniaxals, with axes parallel to the lines of force. Colza oil is one of the best examples. All the negative liquids yet known belong to the class of the fixed oils. Sperm oil holds an exceptional place, being clearly positive. The influence of density on electro-optic power is marked and certain in the case of paraffin oils, increase of density being accompanied by increase of electro-optic power.

ELECTRIC DISTILLATION.—The further researches of M. Gernez on the evaporation of water under the in-

fluence of electrification have led him to the conclusion that the water creeps up the walls of the tube in which it is confined, from the positive pole towards the negative. If paraffin be painted on the walls so as to stop this passage of the liquid, the transference of the latter is stopped. There may be a slight formation of vapour under the action of the electrification, but it is very slight indeed, for the vapour collects in the bend of the inverted U tube, and very little reaches the negative pole to condense there. If the liquid experimented upon be a very bad conductor, such as the chloride and sulphate of carbon, chloriform, and essence of turpentine, the distillation does not take place; but, generally speaking, when the discharge passes, the transport is greater the less the conductivity of the liquid. Thus, if alcohol be added to distilled water, lessening its conductivity, the transport is increased; and, on the other hand, if sulphuric acid be added to water, so as to improve its conductivity, the transport is reduced. A homogeneous mixture of two liquids under the electric action results in their partial separation, for they are found to distil over in proportions which are neither in ratio with the volatility nor the conductivity of the liquids. For example, in operating with a mixture of alcohol and water, a liquor less rich in alcohol is obtained.

ELECTRO-DYNAMIC INDUCTION.—MM. Borgman and Ziloff, starting from the formula of Clerk Maxwell, have arrived at the conclusion that a dielectric medium does not influence electro-dynamic induction, but, on the other hand, a magnetic medium increases the electromotive force of induction in the ratio of 1 to $1 + 4\pi k$, where k represents the magnetising function of the medium. M. Borgman also finds that the medium influences the duration of the induced current.

THE thermo-electromotive force set up at the contact of a conductor with a wire carrying a current has been made the subject of a recent investigation by M. Borgman, of St. Petersburg. It is known that a change of structure takes place in a conductor by the passage of a current through it, and M. Borgman finds this change capable of producing a thermo-electric force. After reducing to zero the current in a Wheatstone bridge, formed of iron wire traversed by a powerful current, the author heated one of the contact points and occasioned a deflection of the needle. Reversing the battery changed the direction and amount of the deflection, thus proving the existence of an electromotive force in the bridge itself.

THE RATAPHONE is the name given by Prof. Dolbear to a new telephone of his invention, which is a kind of cross between the Bell receiver and the motograph of Edison. It consists of a short straight bar electromagnet furnished with a crank, so that it may be rotated within its coil. Lying on the poles are the ends of a bent armature (of horse-shoe form), the back of which is fastened to a plate of mica, or paper, or thin iron, mounted as in ordinary receivers, so that any motion of the armature poles will be imparted to the plate. When a current traverses the bobbin, the straight bar becomes a magnet, with strength proportionate to the strength of the current, and the armature adheres to the poles of it with a certain strength of adhesion. Now let the crank be turned slowly, and the adhesion of the armature will result in stretching the plate, and the cessation of the current will let the plate regain its former position through its elasticity. A varying current will result in varying adhesions and consequent vibrations of the plate, and talking may be plainly heard with an instrument constructed thus.

New Patents—1879.

3565. "Dynamo-electric machines." W. ELINOR. Sept. 4.

3577. "Signals for telephone and telegraph lines." W. T. WHITEMAN (communicated by S. W. Francis). Complete. Sept. 5.

3645. "Electric telegraphs." W.C. BARNEY. Sept. 11.

3653. "A new or improved toy, wherein figures are moved by means of magnets." G. W. VON NAUROCKI (communicated by N. Kamprath). Sept. 13.

3659. "Improvements in means employed for electrical firing, and in fuses for the same." S. J. MACKIE. Sept. 13.

3679. "Insulators for telegraph wires." G. F. REDFERN (communicated by J. H. Bloomfield). Sept. 13.

3777. "Improvements in or applicable to electric and other puncturing pens employed for manifold writing." T. COAD. Sept. 19.

3778. "Improvements in the manufacture of metal rods or wire with a vitreous coating chiefly designed for telegraphic cables, and in devices for aligning and coupling such cables." W. R. LAKE (communicated by P. Arbogast and T. J. McTighe). Complete. Sept. 19.

3794. "Improvement in apparatus employed in connection with telephones, for the purpose of notifying and of facilitating and obtaining interchangeable communication between telephonic circuits." A. WHITE (communicated by T. A. Edison). Sept. 20.

3831. "Protecting and insulating underground telegraph wires." P. JENSEN (communicated by W. E. Prall and H. Olrick). Sept. 23.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1879.

382. "Electric lamps." JOHN IMRAY. Dated Jan. 30. 2d. This consists in making electrodes out of hollow carbon tubes, which rotate round their axis at the same time that they are made to approach each other, so as to cause the consumption of carbon to take place in a helical direction, so that each tube furnishes a length of carbon equal to the length of the helix. *(Not proceeded with.)*

389. "Reflectors for electric lighting apparatus." W. R. LAKE. Dated January 30, 2d. To obtain a diffusion of the electric light, without waste from the use of thick globes, reflectors of silvered glass are to be employed. *(Not proceeded with.)*

390. "Protecting coating for ships, telegraph cables, &c." GEORGE WATSON. Dated January 30. 2d. To protect cables or submarine structures from oxidation or from fouling by animal or vegetable growths, "sene-grease" (obtained from coal tar, fats, &c.) is to be applied by a brush, or by soaking the sheathing of the cable. The grease is made into the consistency of paint by mixing it with naphtha, resin, &c.

394. "Telephones." F. A. GOWER and C. ROOSEVELT. Dated January 30. 6d. This describes Gower's well-known form of telephone.

412. "Compound microphones." L. J. CROSSLEY. Dated Feb. 1. 6d. This describes the quadruple-contact or four-carbon microphone, fully illustrated in the TELEGRAPHIC JOURNAL for May 1.

416. "Electric lamps." J. D. F. ANDREWS. Dated Feb. 1. 2d. The electrodes are formed of two carbon discs placed fronting each other, and the arc is formed

between the edges. As these consume, the arc travels round, gradually paring down the carbons towards their centre. *(Not proceeded with.)*

427. "Electric lamps." C. DUBOIS. Dated Feb. 3. 4d. This describes a lamp in which the carbons are of a curved shape like those of Mr. Heinrichs, illustrated in our last number.

465. "Luminous electric buoys." S. W. M. De Sussex. Dated Feb. 5. 2d. This describes modifications on the buoy patented in No. 2,194, of 1877. The buoy is lighted by a discharge from a Ruhmkorff coil, excited by a zinc-graphite battery attached to the buoy or within it, the discharge passing through a Geissler tube containing hydrogen or carburetted hydrogen as giving the most brilliant light. The tubes are made several feet long, then rolled into a luminous centre, and they are enclosed in a lantern of crystal or, preferably, uranium glass. *(Not proceeded with.)*

477. "Galvanic batteries." T. SLATER. Dated Feb. 6. 6d. Nickel in a rod or in grains is used for the positive pole, and carbon in rods or prisms for the negative, with a porous diaphragm between, where two fluids are used. The excitant may be dilute sulphuric, nitric, or hydrochloric acid. A compound cell is also made with two concentric diaphragms which divide it into three compartments; in the centre is the nickel with its oxidiser, the dilute acid; in the middle one is a solution of sesqui-carbonate of ammonia, and in the outer is a solution of sulphate of nickel or double sulphate of nickel and ammonia together with the carbon plate.

485. "Sounders for telegraphic purposes." J. R. EDWARDS. Dated Feb. 7. 2d. Below the long pole of the ordinary sounder an electro-magnet is fixed, whose core passes through the long pole of the permanent magnet, and is magnetised by it and made in two adjustable parts. Another electro-magnet is placed below the shorter pole of the permanent magnet. The iron cores of these electro-magnets face each other with an adjustable space between. An armature carrying the striking hammer is pivoted to the short pole of the permanent magnet and magnetised by it. This armature is operated by the current passing through electro-magnets which reverses the polarity of the upper, and the armature is pulled down and strikes the bell. *(Not proceeded with.)*

508. "Shades of lanterns for electric lights." H. VAN DER WEYDE. Dated Feb. 8. 6d. To diffuse the light, annular reflectors in parallel zones are employed in two sets separated by an equatorial band or prism of glass, and they are slightly concave, the upper set on their lower and the lower on the upper surface. They are placed so as to intercept the upwardly and downwardly projected rays and throw them out horizontally.

523. "Electric light." E. J. BOUSFIELD and W. R. BOUSFIELD. Dated Feb. 10. 6d. This consists in constructing the armature of dynamo-electric machines in the form of a drum with coils surrounding H shaped cores; in a regulator or brake for adjusting the electrodes of an electric lamp consisting of an iron-rimmed wheel acted on by the pole of an electro-magnet near it through which the current passes, so as to retard the motion of the wheel when the current was strong, and thus check the approach of the carbons.

The use of a negative metal electrode, kept cold by a cold blast, for carbon, after the manner of Siemens, is also described.

595. "Generating compound induced currents for telephonic and other purposes." R. H. COURTENAY. Dated Feb. 14. 2d. This consists in uniting a magneto-electric generating apparatus to the ordinary apparatus for telephoning musical sounds. *(Void by reason of the patentee neglecting to comply with the conditions of letters patent.)*

644. "Magneto-electric or dynamo-electric machines." J. F. WILES. Dated Feb. 18. 6d. Instead of fixing either the magnets or armatures in position and causing the one or the other to revolve as heretofore, both the magnets and the armatures are mounted on separate axes of motion, so that the armatures are revolved in one direction while the magnets are revolved in the other, whereby the same relative speed of the parts as that now obtained may be produced whilst giving a slower rotary motion to the axes on which the same are mounted. By these means the machine can be driven direct from a steam engine or by other motive power without the intervention of any description of multiplying apparatus.

749. "Galvano-magneto-dynamo-electric machine." C. DUBOS. Dated Feb. 25. 6d. The electro-magnets of this machine are made in the form of double rings of soft cast-iron, having segmental collars on them, between each pair of which insulated wire is coiled transversely to the circumference of the ring over the double annular cores, each coil being so wound and so connected in the circuit of the machine, that the electrical current through its coil is in the opposite direction to that in the next coil on each side of it. Within this annular electro-magnet is a rotatory disc set with armature coils. The ring coils are first excited by a battery.

General Science.

GLASS SLEEPERS.—Rail and tramway sleepers of glass, hardened by the Siemens' process, have recently been introduced into this country, and are being tried on the Stratford tramways.

LUMINOUS FLOWERS are one of the latest novelties on the Parisian boulevards. They are made by varnishing the petals with phosphorescent sulphide of calcium or sulphide of barium, and shine with a lambent light in the dark.

ILLUMINATING GAS FROM RICE HUSKS.—A process calculated to be of great value in rice-producing countries, has been patented in this country by Mr. Muller, a young Dutchman, now resident in London. It consists in decomposing the chaff of rice in a retort by heat, and collecting the illuminating gas given off. By this means from 15,000 to 20,000 cubic feet of excellent gas can be obtained from a ton of husks. The carbonaceous residue is kneaded with tar or oil into an artificial fuel.

THE CHROMOGRAPH AND TRYPTOGRAPH are new devices for multiplying copies of manuscripts. By the Chromograph the writing while fresh is transfered to an elastic tablet, and as many as fifty copies are impressed therefrom by merely laying the paper on it and passing the hand over the back. By the Tryptograph a stencil is made by writing on a plate which pierces the paper, and copies are made from the stencil after the manner of Edison's Electric Pen or the Horograph.

FORBES'S ACOUSTICAL FIRE-DAMP DETECTOR.—This handy little instrument is intended to measure the quantity of fire-damp in a coal mine. From the rough model shown by Prof. George Forbes, of the Andersonian University, Glasgow, the committee of the British Association have constructed two new

instruments which appear to them to answer their purpose. Both are founded on the facts that sound travels quicker in light gases than in dense ones, and that air which is contaminated with fire-damp is lighter than pure air. The velocity of sound in different qualities of air is compared by noting the lengths which must be given to a brass tube to cause it to resound to a tuning-fork. The length of tube is proportioned to the velocity of sound. The instrument consists essentially of a tube with a tuning-fork at one end of it and closed at the other end by a piston, which can be moved in and out so as to lengthen or shorten the tube. The tuning-fork is caused to sound, and on moving the piston in and out the sound is heard to augment and diminish according to the position of the piston in the tube. The piston must be left in that position which gives the loudest sound. The length of the tube under these conditions measures the velocity of sound, and thence the percentage of fire-damp in the air. In the larger form of the instrument the fork is kept in vibration by an electric current, which is made and broken at each vibration by the fork interrupting the circuit of an electro-magnet. In the smaller form the fork is put in vibration by means of a tapering rod drawn between the prongs by hand. A thermometer attached enables a small correction for temperature to be made, and the percentage of gas to within 1 per cent. is pointed out on an indicating dial.

A NEW FLUORESCENT BODY.—According to the *Journal of the Chemical Society*, C. O. Harz has discovered a new fluorescent body in *spergulin*. This product occurs in the seed-coverings of the caryophyllaceous plants, *Spergula vulgaris* and *S. maxima* (Anglice "Spurrey"). It is produced at the time when the seeds blacken and are nearly ripe. Spergulin is very soluble in absolute and aqueous alcohol. Viewed by transmitted light the solution appears nearly colourless, with a shade of olive-green; by reflected light it exhibits a dark blue fluorescence. It has not yet been obtained in the form of crystals. It is very soluble in methylic alcohol, less so in amylic alcohol, and scarcely soluble in ether or petroleum. Concentrated sulphuric acid dissolves it, forming a dark blue liquid. The fluorescence of an alcoholic solution of spergulin is maintained for more than a year if the liquid be kept in darkness, but is rapidly destroyed by the action of direct sunlight, and more slowly by that of diffused light. Small quantities of caustic alkalies, or alkaline carbonates, added to an alcoholic solution of spergulin, transform it into an emerald-green fluorescent body; and basic lead acetate produces a precipitate. The new compound contains 61·85 per cent. of carbon, 7·05 of hydrogen, and 31·8 of oxygen. It appears to be related to chlorophyl, and is probably closely allied to phyllocyanin. An alcoholic solution of the product showed strong absorption, almost entirely in the violet; and in this respect differs considerably from chlorophyl, phyllocyanin, and phylloxanthin. Mr. Harz is disposed to regard spergulin as a feeble acid, the acid salts of which, as well as the acid itself, exhibit blue fluorescence, the neutral salts exhibit green fluorescence, and the basic salts are destitute of fluorescent properties.

MALLEABLE NICKEL AND COBALT.—A German chemist, Herr Fleitmann, has succeeded in producing perfectly malleable nickel and cobalt on removing the carbonic oxide observed by them, by adding small quantities of magnesium through a hole in the lid of the crucible after the oxygen had been removed by means of charcoal.

TRANSPARENCY OF METALS.—With the aid of electricity films of several metals of such minute thickness as to allow the light to pass through them can be produced. An electric current is passed into a wire of one of the metals, that extends into a glass tube containing rarefied air or gases. The particles of metal that the electric current loosens from the wire are deposited on the sides of the tube and form a transparent film. The light that passed through gold was a very handsome green, silver produced blue, copper light green, platina bluish gray, zinc dark bluish gray, and iron brown.—*Chemiker Zeitung*.

OZOKERITE.—A large deposit of ozokerite, 20 miles long and 20 feet thick, has been discovered in Utah territory, U. S. It is harder than the ordinary ozokerite; but its insulating properties have not as yet, we believe, been tested. The production of ozokerite oil in the Eastern Galicia oil fields is very limited in amount at present. The wells are mostly situated near Boryslaw, though there is one well south of Boryslaw about 45 miles, that is doing 8 to 10 barrels per day of nice green oil. The wax fields of Eastern Galicia attract the most attention. This earth wax, or ozokerite, as it is called, is neither more nor less than oil that has been evaporated, leaving the residuum in a solid state, so that it is dug out with picks and shovels, and is about the consistency of common clay. It is very valuable, being worth from 7 to 8 cents a pound. The shafts are from 350 to 600 feet deep and very close together, so close that, on the piece of land where this wax is found at Boryslaw, containing not over 50 acres, there are 10,000 shafts. The walls of these shafts are curbed with timbers, but at the depth to which they go they are very thin, so that scarcely a day passes but the walls cave in, breaking the timbers like pipe stems, and burying several human beings beneath the great mass of earth. This thing occurs so frequently, that from four to six persons per week are killed in this manner. Great fortunes have been accumulated by a few of the Jews who owned the land where the wax was found. The vein is about 16 inches thick, and the wax is carried out in buckets. Twelve thousand men live on that 50 acres of land, how, nobody knows. The wax is refined and made into candles; and, being an excellent insulator, also into condensers for electrical purposes.

MOVING ROCKS.—It is well known that the shingle of a sea-beach slowly travels along the shore, and a remarkable instance of the fact is to be found in the great Chesil bank of a natural breakwater of shingle curving between the island of Portland and the Dorset coast near Weymouth. Here the pebbles are actually assorted by the action of the tide, so that the larger ones are met with at the east end towards Portland, while the smaller ones become more abundant as one follows the bank in a westerly direction. So regular is the grade of size that fishermen who land at night on the bank can tell roughly how far they are from Portland by handling the pebbles. Moving rocks are, however, a more remarkable and unheard-of phenomenon. That daring sportsman, Lord Dunraven, has recently given an interesting account of some which he witnessed at a lake in Nova Scotia during the autumn of last year. The lake itself was spacious but shallow, and its bed was strewn with masses of rock of various sizes, from boulders six or eight feet in diameter to stones of a few pounds' weight. Many of these blocks appeared to have travelled right out of the water, and are now high and dry several yards up the shore. In all cases there is a distinct groove or furrow marking the track which the rock has ploughed for itself. The only cause of the curious fact which Lord Dunraven can suggest is the action of ice, but how the ice acts he does not venture to explain.

City Notes.

Old Broad Street, Sept. 27th, 1879.

DIRECT SPANISH TELEGRAPH COMPANY LIMITED.—The report of the directors for the half-year ending 30th June, 1879, to be presented at the general meeting of shareholders being held as we go to press, states that, "the accounts for the half-year ending 30th June, 1879, show a balance to the credit of profit and loss of £3,445 18s. 3d. The traffic receipts for the half-year are £545 17s. 10d. in excess of those for the corresponding half-year of 1878. This result has been attained in the absence of any improvement in business in Spain. The company's submarine cables continue to work perfectly, and remain in the same high electrical state as heretofore. The dividend on the 10 per cent. preference shares, which it is proposed to pay on 1st October, will absorb £2,921 10s. 0d., leaving £524 8s. 3d. Of this sum the directors recommend that £500 be added to the reserve fund, which will then amount to £2,200, after which there will remain a balance of £24 8s. 3d. to be carried forward."

DIRECT U.S. CABLE COMPANY.—By the Articles of Association of this Company, the Directors are expressly authorised to borrow £100,000, and to issue debentures for the same on such terms and conditions as they may think fit. Previously to and at the last Ordinary General Meeting of the Company, the Members were informed that, in order to complete the financial arrangements for the settlement of the interests of the dissentients from the re-construction, and for the general purposes of the Company, it was intended to exercise the debenture power given by the Articles. The Directors have now decided to make the issue in 1,000 debentures of £100 to bearer, repayable in five years from the 15th October, 1879, bearing interest at £6 per cent. per annum (payable half-yearly), and to offer the same in the first instance to the Members at par.

At a meeting of the board of the Anglo-American Telegraph Company (Limited) to-day it was resolved (after placing £37,500 to the credit of the renewal fund) to declare the following dividends, all free of income-tax and payable on Nov. 1, 1879, leaving about £7,000 to be carried forward to next quarter's account: 1. An interim dividend of 1½ per cent. upon the ordinary consolidated stock for the quarter ending Sept. 30, 1879; 2. An interim dividend of 1½ per cent. upon the deferred stock for the same quarter; and 3. A balance dividend for the year 1879 of 1½ per cent. upon the Six per Cent. Preferred Stock. No further dividend will be payable on this stock for the year 1879.

The directors of the Eastern Telegraph Company (Limited) have declared an interim dividend of 2s. 6d. per share for the quarter ended June last.

The directors of the Eastern Extension Telegraph Company (Limited) have declared an interim dividend for the quarter ended June 30 last, of 2s. 6d. per share, or at the rate of 5 per cent. per annum, free of income-tax.

The board of the Indo-European Telegraph Company have declared an interim dividend for the half-year ending June 30 last, at the rate of 5 per cent. per annum, free of income-tax.

The following are the final quotations of telegraphs:—Anglo-American, Limited, 55½-55⅝; Ditto, Preferred, 82½-83; Ditto, Deferred, 29-30; Brazilian Submarine, Limited, 6⅞-7⅛; Cuba, Limited, 7¼-7⅜; Cuba, Limited, 10 per cent. Preference, 15-16; Direct Spanish, Limited, 1⅞-2⅛; Direct Spanish, 10 per cent. Preference, 11¼-11⅜; Direct United States Cable, Limited, 1877, 10¾-11; Eastern, Limited, 7⅞-8; Eastern, 6 per cent. Debentures repayable October, 1883, 104-108; Eastern 5 per cent. Debentures repayable August, 1878, 102-104; Eastern, 6 per cent. Preference, 11⅛-12⅛; Eastern Extension, Australasian and China Limited, 7⅞-8; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 105-108; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, par 1 pm; Ditto, registered, repayable 1900, par 2 pm; German Union Telegraph and Trust, 7⅞-8; Globe Telegraph and Trust, Limited, 4⅞-5⅛; Globe, 6 per cent. Preference, 11¼-11½; Great Northern, 8⅜-8½; Indo-European, Limited, 21⅛-22⅛; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9-9½; Reuter's, Limited, 9-10; Submarine, 224-229; Submarine Scrip, 2-2½; West Coast of America, Limited, 1-1½; West India and Panama, Limited, 1½-1⅝; Ditto, 6 per cent. First Preference 7-7½; Ditto, ditto, Second Preference, 6-7; Western and Brazilian, Limited, 2½-3; Ditto, 6 per cent. Debentures "A," 95-99, Ditto, ditto, ditto, "B," 89-94; Western Union of U.S. 7 per cent., 1 Mortgage (Building) Bonds, 120-125; Ditto, 6 per cent. Sterling Bonds, 104-106; Telegraph Construction and Maintenance, Limited, 31½-32; Ditto, 6 per cent. Bonds, 105-107; Ditto, Second Bonus Trust Certificates, 2½-2⅝; India Rubber Co., 12¼-12⅜; Ditto, 6 per cent. Debenture, 102-106.

TRAFFIC RECEIPTS.

Name of Co., with amount of issued capital, exclusive of preference and debenture stocks.	Anglo-American Co. £7,000,000.	Brazilian Sub. Co. £1,300,000.	Cuba Sub. Co. £160,000.	Direct Spanish Co. £116,379.	Direct U.S. Co. £1,213,900.	Eastern Co. £3,697,000.	Eastern Ex. Co. £1,997,500.	Gt. Northern Co. £1,500,000.	Indo-Euro. Co. £425,000.	Submarine Co. £338,225.	West Coast America Co. £300,000.	Western and Brazilian Co. £1,398,200	West India Co. £883,210.
	£	£	£	£	£	£	£	£	£	£	£	£	£
August, 1879 ...	51,300	*9,880	2,300	978	17,100	36,257	25,242	16,800	... ...	10,789	... ...	11,113	3,884
August, 1878 ...	43,720	11,244	2,569	879	14,570	35,889	24,870	18,413	... ...	10,151	... ...	... ...	4,417
Increase	7,580	*	... ...	99	2,530	368	1,372	... ...	... ...	638	... ...	... ...	... ...
Decrease	... ...	... ...	269	... ...	... ...	... ...	... ...	1,613	... ...	... ...	... ...	... ...	533

* Four weeks only, against 31 days of last year.